POLLOCK (POLLACHUIS VIRENS) AS A FOOD FISH FOR MILITARY PROCUREMENTS

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POLLOCK (POLLACHUIS VIRENS) AS A FOOD FISH FOR MILITARY PROCUREMENTS

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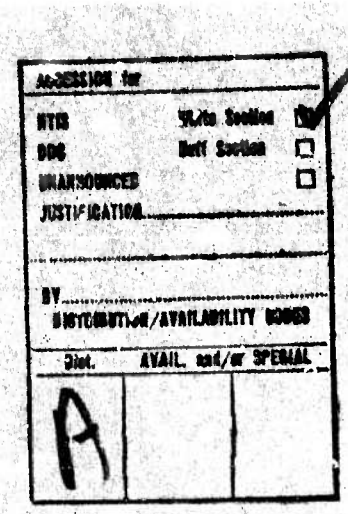

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Fresh processed pollock fillets (processed with 24 hours of catch) and standard processed fillets (processed 6 days after catch) were frozen as fillets or as pollock fish blocks at -18°C.

Fillets were stored up to 18 months at -18°C and evaluated for sensory changes at 3 month intervals. Zero, 3 and 6 month old frozen pollock blocks were divided into 28.3 gram fish sticks, breaded and stored as sticks up to 18 months at -18°C. The breaded sticks were evaluated for sensory changes and overall quality at 3 month intervals.

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20. Abstract (Con'td)

Both the fresh and standard processed fillets are considered acceptable after 12 months frozen storage whether processed as fillets or as breaded fish sticks. The sensory ratings indicate that the pollock species so processed is suitable for military procurement.

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The authors express appreciation to Lt. Stanley Miller for his assistance in analyzing the data.

FOREWORD

The North Atlantic Ocean is being depleted of in-shore fish species. Once prevalent species such as haddock and cod have become of increasing economic concern to the New England fishing industry.

Concern for its survival as a vital industry prompted an investigation into possible commercial outlets for less known fish species such as pollock (pollachuis virens) a close relative to the haddock and cod species. Pollock has been less desired due in part to its color which is not as white as haddock and cod and due to its characteristic of feeding at different ocean depths at different times of the year. Fishing gear with flexibility for variable depth fishing is much more costly than fixed depth fishing gear.

The U.S. Dept of Interior has come to the aid of the New England fishing industry by subsidizing the cost of converting fixed to variable depth gear. Since no previous studies were available as to the stability of frozen pollock in long term storage at -18°C, this study was initiated to determine the acceptability of the pollock species.

Acceptance of the pollock species for military procurement could be of economical benefit to both the New England fishery industry and the combined military services.

This study was undertaken under the DOD PE in support of stock fund Food and Food Service Items program.

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INTRODUCTION

Haddock and cod are important fish species used as food items by the military services. Since these and other important species are declining in abundance, supplementary or replacement species need to be considered.

Based on predictions of fish population and recorded landings during the period 1963 through 1969; the Bureau of Commercial Fisheries stated that the decline of the New England haddock had been declared a resource disaster by the U.S. Secretary of the Interior.

The fishing industry has therefore considered the possibility of marketing pollock as an alternate for cod and haddock. Initial exploratory experimental fishings for pollock by the Bureau of Commercial Fisheries have been successful, and prospects for the new fish resource are promising.

NLABS, recognizing the Department of Defense as a primary customer for frozen cod and haddock, made inquiries to the Bureau of Commercial Fisheries Gloucester Laboratories for information regarding the storage characteristics of pollock sticks and fillets.

It was learned that no definite information on the storage life of pollock was available. (Lane 1964) (Peters 1964). Therefore, frozen storage studies of pollock fillets and breaded fish sticks were undertaken by the Food Laboratory, NLABS, in support of military service procurements.

EXPERIMENTAL PROCEDURE

This study consisted of evaluating the frozen storage life (-18°C) of pollock fillets and pollock sticks prepared from frozen pollock blocks. The raw material for this study consisted of pollock processed within 24 hours of catch (fresh catch) and pollock processed after the usual commercial practice of holding six days aboard ship on ice prior to processing (standard catch).

Fillet Processing Procedure

Both the "fresh" and "standard" fillet catches were filleted and frozen to -18°C within 24 hours of landing. Sensory evaluations of the frozen fillets were made at 3 month intervals during a total storage period of 18 months. The fillets were prepared for each sensory evaluation by oven-cooking at 190°C for approximately 25 minutes before offering to the panelists. This time temperature combination was sufficient to cook the fillets to a flaky center texture. One entire fillet was given to each panelist. Evaluations were made by 20experienced panelists.

Breaded Fish Stick Processing Procedure

Since it is a common practice in industry to freeze fish fillets in blocks and then manufacture fish sticks at a later date, a fish block factor was introduced into the experiment. Fish sticks were made from 7.27 kg. fish blocks stored 0, 3, and 6 months at -18°C. The blocks were cut into 28.3 g sticks (5.1 cm x 2.5 cm x 1.3 cm) by use of a band saw while in the frozen state. The sticks were breaded with commercial breading and then quickly refrozen in poly bags inside chip-board cartons. The sticks were held an additional 18 months at -18°C after manufacture from the 0, 3 or 6 month old blocks. Sensory evaluations of the frozen fish were made at 3 month intervals while holding the sticks in -18°C storage for a total of 18 months. The sticks were prepared for each sensory evaluation by deep fat frying in vegetable oil at 190°C for 3 minutes before offering to the panelists. Three unseasoned fish sticks were given to each panelist for his evaluation.

The sensory parameters which were evaluated for both fillets and sticks were color, odor, flavor, texture and appearance. The rating scale for these parameters were 1= extremely poor, 2= very poor, 3= poor, 4= below fair-above poor, 5= fair, 6= below good - above fair, 7= good, 8=very good, 9=excellent. Throughout this study, sensory values not significantly lower than initial values indicate product acceptance. Where the 12 month sensory values were significantly lower than the initial values but were not lower than a value of 5, the product was considered to be acceptable.

RESULTS AND DISCUSSION

FILLETS

Fresh processed pollock fillets were given a color rating ranging from 6.25 to 6.83 for up to 15 months of storage. At the eighteenth month, the color rating dropped to 5.65(Table 1). Fish fillets stored at 0°F for eighteen months received significantly lower color ratings than those stored for 0,3, 6, 12, or 15 months.

Standard processed fillets were given low color ratings in the initial storage months, increased color ratings from 6 to 15 months of storage,but again were rated down at the end of eighteen months storage. However, these differences were not singificant. (Table 2)

Standard processed fillets were not evaluated at 0 months storage since these fillets were not recieved until 3 months after the study commenced.

Both fresh and standard processed fillets were given lower odor ratings as storage time increased (Table 1 and 2). The fresh processed fillets at 0 months storage were given a mean rating of 7.05, but at the end of 18 months were rated 5.10. However, the odor ratings were not significantly different from the initial 7.05 rating until 9 months of storage. (Table 1.) Although the odor was significantly less desirable after 9 months of storage, it was acceptable; that is; received a 6.10 rating.

The odor ratings of the standard processed fillets for the 3, 6, 9 and 12 months storage were not significantly different and were considered to be acceptable. At the fifteenth month of storage, a significant decrease in odor rating was noted. (Table 2.) At the eighteenth month the odor rating was still lower at 5.15.

The flavor of fresh processed pollock fillets received a 6.50 rating at 0 months storage, and retained an acceptable flavor until between 12 and 15 months storage. (Table 1.) After 18 months of storage, the flavor had deteriorated considerably and was rated 4.90.

The flavor of standard processed fillets showed no significant decrease until 18 months of storage. (Table 2)

After three months at -18°C both fresh and standard processed pollock fillets steadily decreased in flavor, during the remainder of the eighteen month storage period. However, the fillets by both processes were acceptable for up to 12 months.

Texture of both fresh and standard processed pollock fillets received increasingly better ratings as storage time increased up to 12 months for the fresh, and 15 months for the standard process where a peak was reached. (Table 1 and 2). Likewise both type fillets recieved ratings comparable to initial texture ratings after 18 months.

In respect to appearance, a slight trend of decreasing acceptance was evident with the fresh processed pollock fillets. (Table 1) There was no significant difference in ratings over the 18 months for the standard processed fillets. (Table 2)

Fish Sticks

There were no significant differences in color ratings over the 18 month storage between sticks made from the 0 and 3 month old fresh processed blocks. (Table 3) The 6 month blocks showed significant color differences over the 18 month study, but no definite trend was established. Although significant color differences developed among the sticks from the 6 months blocks the lowest rating was an acceptable 6.22.

There was no significant difference in color ratings for sticks made from standard processed blocks. (Table III)

Significant differences occurred in odor ratings for sticks made from both fresh and standard processed blocks. (Table IV)

As seen in Table IV this trend seemed to be a more regular decrease with the fresh processed fish, although odor ratings remained acceptable for both fresh and standard processed fish over the 18 months of storage.

Flavor ratings for sticks made from fresh processed blocks decreased in the initial months of the study, but increased to some degree toward the end of the study. In line with the desired 12 month acceptability requirement for military storage, the sticks from fresh processed blocks were considered to be acceptable.

There was no significant difference in flavor of sticks from all age blocks of standard processed pollock fish, (Table 5.) Ratings were considered to be acceptable throughout the storage period,

Texture ratings of fish sticks from both fresh and standard processed blocks showed a downward trend as storage time increased. As seen in Table 6, there were significant differences in texture ratings for sticks made from 0, 3, and 6 month fresh processed blocks. However, the texture ratings were acceptable after 12 months of storage.

The texture ratings of fish sticks made from 0 and 3 month standard processed blocks showed no significant differences. (Table 6). Sticks made from the 6 month standard processed blocks had significant texture differences, but received an acceptable 6.25 rating after 12 months of storage.

SUMMARY

Pollock fish fillets processed and frozen within 24 hours after catch and then stored 12 months at -18°C, were rated "below good, above fair" for color, odor, flavor, texture, and appearance. Pollock fillets from fish held on ice 5 to 6 days after catch prior to filleting and freezing, received a "below good above fair" rating on color and odor after 12 months of storage. These fillets recieved a "fair" rating on flavor, texture and appearance. These ratings indicated that pollock fillets are suitable and meet military requirements.

Breaded fish sticks made from fresh and standard processed pollock, stored 0, 3, and 6 months in blocks and then cut into fish sticks, received an acceptable color rating ranging from 6.35 to 7.33 after 12 months storage at -18°C. Odor ratings ranged from 5.70 to 6.62, flavor 5.50 to 6.26, texture 5.46 to 6.48 and appearance 6.00 to 7.14 after 12 months of storage at -18°C. Since all these ratings meet the acceptable criteria, breaded pollock fish sticks made from frozen blocks up to 6 months of age will provide a fish stick product suitable for military service procurement.

Table 1. Mean sensory ratings for fresh processed pollock fillets stored for 0 to 18 months at -18°C.

Storage Months of Fillets	Color	Odor	Flavor	Texture	Appearance
0	6.35^{a}	7.05^{a}	6.50^{a}	5.25^{bc}	6.65^{a}
3	6.60^{a}	7.00^{a}	6.93^{a}	5.73^{b}	6.33^{a}
6	6.83^{a}	6.83^{ab}	6.46^{a}	5.42^{bc}	6.67^{a}
9	6.25^{a}	6.10^{bc}	5.85^{ab}	5.85^{ab}	6.00^{ab}
12	6.52^{a}	6.00^{bc}	6.10^{ab}	6.71^{a}	6.62^{a}
15	6.45^{a}	5.40^{c}	5.30^{bc}	5.75^{b}	6.10^{ab}
18	5.65^{b}	5.10^{d}	4.90^{c}	4.75^{c}	5.40^{b}

Note - any two means not followed by a common letter within a column differ significantly at the 5% level of probability.

Table 2. Mean sensory ratings for standard processed pollock fish fillets stored for 0 to 18 months at -18°C.

Storage Months of Fillets	Color	Odor	Flavor	Texture	Appearance
0	-	-	-	-	-
3	5.90^{ns}	6.65^{a}	6.40^{a}	5.00^{b}	5.95^{ns}
6	5.67	6.53^{a}	6.73^{a}	5.00^{b}	5.13
9	6.29	6.58^{a}	5.96	5.33^{b}	6.08
12	6.45	6.45^{a}	5.90^{a}	5.85^{ab}	5.60
15	6.29	5.85^{b}	5.95^{a}	6.43^{a}	6.38
18	5.95	5.15^{b}	5.00^{b}	5.10^{b}	5.80

Note - any two means not followed by a common letter within a column differ significantly at the 5% level of probability. NS= non significant.

Table 3. Mean sensory color ratings for pollock fish sticks stored 0 to 18 Months at -18°C.

Storage Months of Sticks	Storage Months of Fish Blocks Prior to Manufacture of Sticks					
	Fresh Process			Standard Process		
	0	3	6	0	3	6
0	6.47^{ns}	7.00^{ns}	7.05^{ab}	-	6.79^{ns}	6.21^{ns}
3	6.26	6.73	6.55^{bc}	6.32^{ns}	6.36	6.57
6	6.65	6.90	7.37^{a}	6.64	6.30	6.40
9	5.45	6.83	6.33^{c}	5.91	6.10	6.58
12	6.35	7.33	6.61^{bc}	6.35	6.40	7.05
15	6.33	6.73	6.82^{c}	6.60	6.80	5.96
18	6.13	6.50	7.04^{ab}	5.50	6.65	6.70

Note - any two means not followed by a common letter within a column differ significantly at the 5% level of probability. NS= non significant.

Table 4. Mean sensory odor ratings for pollock fish sticks stored 0 to 18 months at -18°C.

Storage Months of Sticks	Storage Months of Fish Blocks Prior to Manufacture of Sticks					
	Fresh Process			Standard Process		
	0	3	6	0	3	6
0	6.79^{ab}	6.93^{a}	6.82^{ab}	-	6.90^{ns}	6.14^{ab}
3	6.87^{ab}	6.68^{ab}	6.45^{bc}	6.95^{a}	6.07	6.65^{a}
6	6.91^{a}	6.10^{bc}	6.90^{ab}	6.70^{a}	6.30	5.50^{b}
9	5.55^{d}	6.50^{abc}	6.33^{bc}	6.41^{a}	5.85	6.67^{a}
12	6.37^{abc}	6.62^{abc}	6.48^{bc}	5.70^{b}	6.50	6.52^{ab}
15	6.05^{bcd}	5.91^{cd}	5.96^{c}	6.79^{a}	6.40	5.87^{b}
18	6.00^{cd}	5.59^{d}	7.08^{a}	6.40^{a}	5.87	6.10^{ab}

Note - Any two means not followed by a common letter differ significantly within a column at the 5% level of probability. NS= nonsignificant.

Table 5. Mean sensory flavor ratings for pollock fish sticks stored 0 to 18 months at -18° C.

Storage Months of Sticks	Storage Months of Fish Blocks Prior to Manufacture of sticks.					
	Fresh Process			Standard Process		
	0	3	6	0	3	6
0	6.53^{a}	6.67^{ns}	6.64^{a}	-	6.53^{ns}	6.43^{ns}
3	6.27^{ab}	5.96	6.50^{ab}	6.42^{ns}	5.86	6.22
6	6.61^{a}	5.10	6.11^{ab}	6.29	5.83	6.55
9	5.20^{c}	5.61	5.86^{bc}	5.96	6.05	6.00
12	5.55^{bc}	5.71	6.26^{ab}	6.00	6.05	5.50
15	5.76^{abc}	5.73	5.39^{c}	6.35	6.05	5.35
18	5.52^{bc}	5.36	6.46^{ab}	5.50	5.83	5.91

Note - Any two means not follwed by a common letter within a column differ significantly at the 5% level of probability. NS= nonsignificant.

Table 6. Mean sensory texture ratings for pollock fish sticks stored 0 to 18 months at -18°C.

Storage Months of Sticks	Storage Months of Fish Blocks Prior to Manufacture of Sticks.					
	Fresh Process			Standard Process		
	0	3	6	0	3	6
0	6.42^{a}	6.73^{a}	6.71^{ab}	-	6.42^{ns}	6.36^{ab}
3	6.13^{ab}	6.31^{ab}	6.20^{bc}	6.26^{ns}	6.29	6.57^{ab}
6	6.57^{a}	5.80^{bc}	7.42^{a}	6.79	5.83	7.15^{a}
9	4.95^{abc}	6.44^{ab}	6.10^{bc}	6.[illegible]	6.55	5.95^{b}
12	5.95^{abc}	6.35^{ab}	6.48^{bc}	[illegible]25	5.70	6.25^{b}
15	5.48^{bcd}	5.46^{c}	5.83^{c}	6.15	6.00	5.13^{c}
18	5.22^{cd}	5.86^{bc}	6.00^{c}	5.65	5.70	6.04^{b}

Note - Any two means not followed by a common letter within a column differ significantly at the 5% level of probability. NS= nonsignificant.

Table 7. Mean sensory appearance ratings for pollock fish sticks stored C to 18 minths at -18°C.

Storage Months of Sticks	Storage Months of Fish Blocks Prior to Manufacture of Sticks.					
	Fresh Process			Standard Process		
	0	3	6	0	3	6
0	5.90^{ns}	6.80^{ab}	6.71^{bc}	-	6.42^{ns}	6.14^{bc}
3	6.33	6.71^{ab}	6.20^{c}	5.47^{ns}	6.21	6.78^{ab}
6	6.52	5.20^{d}	7.42^{a}	6.50	5.96	7.15^{a}
9	5.25	5.61^{cd}	6.10^{c}	5.57	6.35	6.53^{abc}
12	6.15	7.14^{a}	6.48^{bc}	6.00	6.05	7.05^{a}
15	6.24	6.73^{ab}	6.13^{c}	6.15	6.35	6.04^{c}
18	5.83	6.32^{bc}	7.00^{ab}	5.15	6.30	6.74^{ab}

Note - Any two means not followed by a common letter within a column differ significantly at the 5% level of probability. NS= nonsignificant.

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